

WHAT IS CLAIMED IS:

1. A method for stripping a layer from a semiconductor wafer, the method comprising:

introducing ozone into a process chamber;

5 activating a water spray for a first predetermined amount of time, thereby creating a water layer over a layer of a semiconductor wafer, wherein the water layer transports high concentrations of the ozone to the semiconductor wafer;

10 deactivating the water spray for a second predetermined amount of time, thereby controlling a thickness of the water layer; and

re-activating and re-deactivating the water spray until the ozone substantially removes portions of the layer from the semiconductor wafer.

2. The method according to Claim 1, further comprising holding the semiconductor wafer stationary.

15 3. The method according to Claim 1, further comprising slowly rotating the semiconductor wafer.

4. The method according to Claim 1, wherein the first predetermined amount of time is approximately five seconds.

20 5. The method according to Claim 1, wherein the second predetermined amount of time is approximately twenty seconds.

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6. An ozone shower system, comprising:

an ozone source configured to supply ozone to a process chamber;

a sprayer connected to a fluid source such that fluid sprays over a workpiece in the process chamber;

25 a pump connected to the fluid source; and

a selector valve connected to the pump, the selector valve configured to selectively pulse the fluid through the sprayer.

7. The ozone shower system of Claim 6 wherein the workpiece is a semiconductor wafer.

Sub 1 8. The ozone shower system of Claim 7 further comprising a cassette that holds a plurality of semiconductor wafers.

9. The ozone shower system of Claim 8 wherein the cassette is configured to rotate.

5 10. A method comprising:  
introducing a reagent to an ambient;  
activating a solution spray in the ambient for a first time period; and  
deactivating the solution spray for a second time period, thereby  
increasing the efficiency of a reaction of the reagent and a workpiece.

10 11. The method of Claim 10 further comprising repeating the activating and deactivating of the solution spray.

12. The method of Claim 10, further comprising rotating the workpiece.

13. The method of Claim 10, wherein the ratio of the first time period over the first time period added to the second time period ranges from 3% to 97%.

15 14. The method of Claim 10, wherein the ratio of the first time period over the first time period added to the second time period is approximately 20%.

Sub B1 15. A reaction chamber comprising:  
a gas input;  
a plurality of nozzles connected to a nozzle manifold;  
20 a wafer cartridge holding wafers;  
a first fluid line connected to the nozzle manifold; and  
a second water line configured to divert water flow away from the first fluid line.

25 16. A reaction chamber comprising:  
at least one nozzle connected to a fluid supply and configured to pulse fluid onto a workpiece; and  
a rotator wherein the rotator rotates the workpiece at a velocity ranging from approximately 100 rpm to stationary.

Sub 1 17. An apparatus comprising:

5                    at least one wafer processing chamber wherein an ozone rich  
environment exists within the wafer-processing chamber;  
a sprayer; and  
a pulsating fluid source, the pulsating fluid source configured to pulse a  
solution through the sprayer into the ozone rich environment.

18.    The apparatus of Claim 17 wherein the solution is ozone rich.

19.    The apparatus of Claim 17 wherein the solution combines with the  
ozone in the ozone rich environment.

10           20.    The apparatus of Claim 17 wherein the sprayer comprises a plurality of  
spray nozzles.

21.    The apparatus of Claim 17 wherein the pulsating fluid source is  
configured to pulse at approximately two pulses per minute.

22.    The apparatus of Claim 17 wherein the pulsating fluid source is  
configured to pulse at approximately one pulse every two seconds.

15           23.    The apparatus of Claim 17 wherein the pulsating fluid source is  
configured to pulse at range from approximately one pulse every two seconds to  
approximately five pulses very minute.

24.    The apparatus of Claim 17 wherein the pulsating fluid source has a  
50% duty cycle.

20           25.    The apparatus of Claim 17 wherein the pulsating fluid source has an  
8% duty cycle.

26.    The apparatus of Claim 17 wherein the pulsating fluid source have a  
duty cycle the varies from 3% to 97%.

25           27.    An apparatus comprising:  
at least one semiconductor processing chamber; and  
a pulsating fluid source, the pulsating fluid source configured to pulse  
an ozone-rich solution into the semiconductor-processing chamber.

28.    The apparatus of Claim 27 wherein the ozone-rich solution further  
combines with ozone in the semiconductor processing chamber.

29. The apparatus of Claim 27 further comprising a spray nozzle that directs the pulsating fluid into the semiconductor-processing chamber.

30. The apparatus of Claim 27 wherein the pulsating fluid source is configured to pulse at approximately two pulses per minute.

31. The apparatus of Claim 27 wherein the pulsating fluid source is configured to pulse at approximately one pulse every two seconds.

32. The apparatus of Claim 27 wherein the pulsating fluid source is configured to pulse at range from approximately one pulse every two seconds to approximately five pulses very minute.

33. The apparatus of Claim 27 wherein the pulsating fluid source has a 50% duty cycle.

34. The apparatus of Claim 27 wherein the pulsating fluid source has an 8% duty cycle.

35. The apparatus of Claim 27 wherein the pulsating fluid source have a duty cycle the varies from 3% to 97%.

36. A method comprising:  
introducing a reagent into an ambient; and  
pulsing a solution spray in the ambient, thereby increasing the efficiency of a reaction of the reagent.

37. The method of Claim 36 further comprising directing the pulsating solution spray onto a workpiece.

38. The method of Claim 36 further comprising directing the pulsating solution spray onto a wafer.

39. The method of Claim 36 further comprising directing the pulsating solution spray onto a wafer during a first time period.

40. The method of Claim 39 further comprising rotating the wafer during at least a portion of the first time period.

41. An ozone shower system comprising:  
a process chamber; and

a pump, connected to the process chamber and configured to pulse a solution into the process chamber.

42. The ozone shower system of Claim 41, wherein the pulse of the solution lasts approximately five seconds.

5 43. The ozone shower system of Claim 41, wherein the pump activates and deactivates to create the pulse.

44. The ozone shower system of Claim 41, wherein the pump further comprises a switching mechanism to create the pulse.

45. The ozone shower system of Claim 44, wherein the switching  
10 mechanism comprises a device configured to divert the solution from one area of the process chamber to another area of the process chamber.

46. An apparatus comprising a pulsator that pulses a solution into an ozone-rich environment to create an ozone-rich solution.

47. The apparatus of Claim 46 wherein the pulsator is a spray nozzle.

15 48. The apparatus of Claim 46 wherein the solution is water.

49. The apparatus of Claim 46 wherein the temperature of the solution ranges from approximately 20°C to approximately 95°C.

50. The apparatus of Claim 46 wherein the temperature of the solution ranges from approximately 60°C to approximately 95°C.

20 51. The apparatus of Claim 46 wherein the temperature of the solution is less than approximately 20°C.

52. The apparatus of Claim 46 wherein the temperature of the solution is greater than 95°C.

Sub 25 53. The apparatus of Claim 46 wherein the ozone-rich environment is within a semiconductor processing chamber.

54. An apparatus comprising:  
a rotating platform that is configured to rotate a workpiece; and  
a pulsator that pulses a solution into an ozone-rich environment to  
create an ozone-rich solution on the workpiece.

55. An apparatus comprising a sprayer that periodically pulses an ozone-rich solution onto a wafer.

56. The apparatus of Claim 55 wherein the pulsator is a spray nozzle.

57. The apparatus of Claim 55 wherein the solution is water.

5 58. The apparatus of Claim 55 wherein the temperature of the solution ranges from approximately 20°C to approximately 95°C.

59. The apparatus of Claim 55 wherein the temperature of the solution ranges from approximately 60°C to approximately 95°C.

10 60. The apparatus of Claim 55 wherein the temperature of the solution is less than approximately 20°C.

61. The apparatus of Claim 55 wherein the temperature of the solution is greater than 95°C.

15 62. An apparatus comprising:  
a rotating platform that is configured to rotate a workpiece; and  
a pulsator that pulses an ozone-rich solution on the workpiece.

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